PATENT ABSTRACTS OF JAPAN

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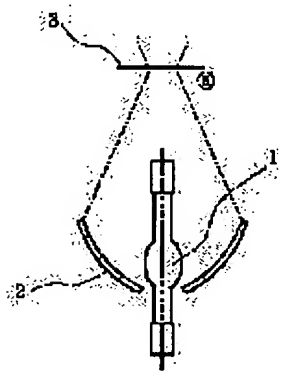
(54) EXPOSING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent the damage to a shutter which has been a neck at the time of increasing the illuminance of an exposing light source for shortening exposure time.

SOLUTION: An exposing device is provided with an illuminating optical system which forms the image of a light emitting section composed of a light source lamp 1 positioned near the first focal point of an elliptic mirror 2 near the second focal point of the mirror 2 with a luminous flux from the light emitting section through the mirror 2 and near the plane of incidence of an optical integrator, in which a plurality of small lenses are two-dimensionally arranged, through an image forming system and illuminates a substrate to be illuminated through the optical integrator, a projection optical system which reduces and projects the pattern of the substrate to be illuminated upon a body to be recorded, and a shutter vane 3 provided on the optical path of the exposing device so as to open/close the exposing optical path between the light emitting section and body to be recorded.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the shutter which shades exposure light especially in an aligner, and the structure of the shutter circumference about the aligner used for manufacture of a semiconductor.
[0002]
[Description of the Prior Art] In recent years, the demand to the densification and high integration to a semiconductor integrated circuit is increasing increasingly. For this reason, in the lithography technique of processing a circuit pattern, it is common that a contraction projection aligner advantageous to detailed-izing of a pattern is used. This contraction projection aligner makes it possible to imprint a detailed circuit pattern to a wafer by carrying out contraction projection of the pattern on a reticle through a projection lens at a wafer, and exposing the photoresist applied to the wafer using the exposure light of fixed wavelength. Wafer susceptor is moved in one pattern, X, or the direction of Y, shading exposure light, after exposing one pattern before exposing the following pattern, in order to expose two or more patterns to one wafer. Under the present circumstances, in order to shade exposure light, the shutter is formed in the contraction projection aligner. moreover, the exposure light drawn with the half mirror prepared into the optical path since proper light exposure was decided by the class of photoresist applied to the wafer, and the class of reticle pattern in case a pattern is exposed to a wafer -- photosensor -- sensing -- or a monitor is carried out, and the closing motion time amount of a shutter is controlled so that the light exposure under exposure becomes a proper value.
[0003] In order to perform this control quickly and correctly, it is necessary to stop the inertia of a shutter as small as possible. In order to make inertia small, as much as possible, it must be miniaturized and the shutter must be lightweight-ized. A shutter is arranged in the small location of the flux of light near the secondary focus of an ellipse mirror for miniaturization achievement. Moreover, a shutter consists of thinnest possible ingredients with small specific gravity for lightweight-ized achievement. Furthermore, the rigidity of a shutter is also required in order to improve a controllability more.
[0004] On the other hand, in connection with a shutter being arranged as mentioned above in the small location of the flux of light, the light which a shutter receives is collected by the part on the front face, and has a possibility of causing a shutter's temperature rise and own thermal deformation, or own breakage accompanying heat-energy-izing of light energy. For this reason, the ingredient of a shutter is equal to a certain amount of temperature rise, and the front face (optical exposure side) of a shutter needs to carry out processing which can prevent the absorption of light as much as possible.
[0005] Moreover, the need for compaction of the exposure time has been increasing for the purpose of improvement in the productivity of a semiconductor device in recent years. As mentioned above, in a contraction projection aligner, since two or more patterns can be burned on a wafer, if the exposure time per time can be shortened by the repeat of exposure and wafer migration, the sum total exposure abbreviated time of the part of the number of patterns can be shortened about one wafer. As mentioned above, although proper light exposure will be decided by the class of a photoresist and reticle pattern,

since light exposure is the value which multiplied the illuminance of exposure light by time amount, for compaction of the exposure time, it is effective [light exposure] to raise the illuminance of exposure light. For this reason, the output of a light source lamp is increasing gradually for the purpose of the illuminance rise of exposure light.
[0006] In such a background, in order to satisfy the above conditions, conventionally, the sheet metal of an aluminium alloy was used for the ingredient, and the shutter with big low inertia, high rigidity, and surface reflection factor has been formed by considering this front face (optical exposure side) as mirror plane finishing.
[0007]
[Problem(s) to be Solved by the Invention] The need for the output rise of a light source lamp is increasing further in the above backgrounds from now on. In connection with this, the light energy and heat energy which a shutter receives increase in the same shutter as usual, and its circumference configuration, and we are anxious about possibility that a shutter will be damaged serving as size.
[0008] According to this invention persons, the following contents shown in drawing 4 were conventionally checked as a typical process to which a shutter results in damage in the shutter of a type.
Namely, step [1st] --a: Light energy absorption on the front face of a shutter.
b: Heat energy absorption of the shutter by heat conduction from the circumference environments (the gas of a periphery, the motor for a shutter drive, shutter attaching part article, etc.) of a shutter.
c: Direct - from a light source lamp Heat energy absorption of the shutter by indirect heat radiation.
Step [2nd] --d: The temperature rise on the front face of a shutter by Above a, b, and c.
Step [3rd] --e: Deterioration of the shutter front face by Above a and d (oxidation by a deposit of the impurity from the interior of a shutter, and the reaction with the open air etc.).
Step [4th] --f: The reflection factor fall on the front face of a shutter by Above e (optical exposure side: mirror plane).
Step [5th] --g: The increment in the light energy absorbed amount on the front face of a shutter by Above f.
Step [6th] --h: The local and rapid temperature rise on the front face of a shutter by Above g.
Step [7th] --i: Deformation, melting, and breakage of the shutter temperature rise section by Above h.
In order to prevent damage on a shutter, in the above process, it is effective to mitigate the factor of an initial stage as much as possible.
[0009] This invention is proposed in consideration of the above point about the shutter for preventing damage on a shutter, and the structure of the shutter circumference.
[0010]
[Means for Solving the Problem] In the process which results in shutter damage as shown in above-mentioned a-i, in order to mitigate each factor and to prevent damage on a shutter, by this invention, solution is aimed at by the following approaches.
** As an ingredient of a shutter, by using an aluminium alloy with more high aluminum purity, while improving the reflection factor of a mirror plane, prevent a deposit of an impurity (dissolution of factor a-e). Or the thermal resistance of a shutter is improved because specific gravity uses a small titanium alloy with the high melting point (dissolution of Factor i).
** the increase of the front face of a shutter -- reflection -- the film -- improve the reflection factor of a mirror plane sharply by forming (dissolution of factor a-c).
** Prevent deterioration of a shutter front face by light transmission nature being good for a shutter front face, and forming the high protective coat of cutoff nature with the open air (dissolution of Factor e).
** Spray the gas for cooling on the periphery of a shutter, or eliminate compulsorily the heat energy which the shutter absorbed, and the heat energy of the shutter circumference by exhausting the gas of the shutter circumference (dissolution of factor b-d).
[0011]
[Function] With the above means or such combination, control of reduction of the energy which a shutter receives, control of a temperature rise, deterioration, deformation of a front face, etc., etc. is attained, and damage on a shutter can be prevented.

[0012]
[Embodiment of the Invention] With one gestalt of operation of this invention, a light-emitting part is arranged near the primary focus of an ellipse mirror. The image of this light-emitting part is formed near the secondary focus of this ellipse mirror through this ellipse mirror by the flux of light from this light-emitting part. The image of this light-emitting part is formed near the plane of incidence of the optical integrator which arranged two or more microlenses two-dimensional through the image formation system. In the projection aligner which illuminates an irradiated substrate through this optical integrator, and carries out contraction projection of the pattern of this irradiated substrate on a substrate through projection optics It is characterized by having the function to prevent the temperature rise of the shutter wing for opening and closing this optical path established on the exposure optical path between the light source lamp for irradiating the recorded body, and the recorded body.
[0013] Light energy absorption of this shutter wing is controlled by forming. if the example of the device in which the temperature rise of said shutter wing is prevented is given -- ** -- the increase of the front face of said shutter wing -- reflection -- the film -- Deterioration of this shutter wing front face is prevented by forming a protective coat in the front face of the ** aforementioned shutter wing which prevents the temperature rise of this shutter wing. Control the increment with time in a light energy absorbed amount, and prevent the temperature rise of this shutter wing. ** ** which cools this section near the shutter wing and prevents the temperature rise of this shutter wing by blowing a gas on said section near the shutter wing compulsorily, and applying it to it -- preventing the temperature rise of this shutter wing etc. occurs by eliminating the gas near [said] the shutter wing compulsorily.
[0014]
[Example 1] Hereafter, the example of this invention is explained using a drawing. Drawing 1 shows the basic layout of a system based on this invention. The flux of light which emitted light with the light source lamp 1 is reflected through the ellipse reflecting mirror 2, and it condenses in the location of the shutter 3 for shading a lamp light. As an ingredient of a shutter, the sheet metal of an aluminium alloy or a titanium alloy is used. Each ingredient performs surface (optical exposure side) polish processing, and is made into a mirror plane.
[0015] It is more effective to damage on a shutter to use an ingredient with more high aluminum purity, when using an aluminium alloy. For example, in A5052P, Mg is contained 2 to 3% as a typical impurity, and this deposits on a front face with an optical exposure, serves as an oxide, and causes a reflection factor fall. On the other hand, in the ingredient of A1050P or A1085P grade, the content of an impurity is 0.5% or less, and possibility that the same phenomenon will occur is very small. Moreover, the surface reflection factor after mirror plane processing has the large effectiveness of there being about 90% of merit value by A1050P or A1085P to being about 85%, and preventing light energy absorption A5052P, in about 300-450nm of dominant-wavelength regions of the light source.
[0016] Specific gravity is about 4.5, a part with high rigidity and thickness can be made thin, and a titanium alloy can stop inertia to the same extent as the case of an aluminium alloy, although it is large to about 2.7 specific gravity of an aluminium alloy. As a description of a titanium alloy, the melting point is about 1800 degrees C, and is very high as compared with the melting point of about 660 degrees C of an aluminium alloy. For this reason, the resistance over the temperature rise of a shutter is size. Moreover, since thermal conductivity is lower than an aluminium alloy, there are few dangers of having a thermal bad influence on other components (motor for a drive etc.) by the temperature rise of a shutter.

[0017] the above-mentioned shutter -- receiving -- the increase of a front face (optical exposure side: a-th page) -- reflection -- the film -- the reflection factor of a mirror plane is sharply improved by coating. An about 300-450nm [of dominant-wavelength regions of the light source] reflection factor is about 40 - 50%, and its amount of light energies which a shutter receives the way things stand is [in / with a titanium alloy / a mirror plane] very large. therefore, the increase of this field -- reflection -- the film -- forming is indispensable. moreover -- the case of an aluminium alloy -- an increase -- reflection -- the film -- formation is effectiveness size.
[0018] The luminous energy which it is possible to pull up the reflection factor in about 300-450nm of

dominant-wavelength regions of the light source to about 98%, and an aluminium alloy and a titanium alloy receive from a light source lamp by forming high reflective multilayers in the front face is mitigable to about 1/5 (in the case of an aluminium alloy), and about 1/25 (in the case of a titanium alloy).

[0019] Moreover, the direct heat energy absorption of a shutter by the radiation from a light source lamp can be prevented by raising the reflection factor in an infrared wavelength region to coincidence.

[0020]

[Example 2] drawing 1 -- setting -- the increase of example 1 -- reflection -- the film -- protective coat coating is instead performed to the a-th page. To this protective coat, cutoff nature with the open air is high, and selects to it the ingredient which does not spoil the reflection factor of a shutter mirror plane. By forming a protective coat, deterioration of the front face by oxidation of the deposit impurity from the interior of an ingredient which was mentioned above and which is generated like at the time of an optical exposure etc. can be prevented.

[0021]

[Example 3] The shutter maintenance parts 5 for fixing the shutter wing 3 are shown in the motor 4 and motor for driving a shutter 3 to drawing 2 . In these near, the air nozzle 4 for forced-air cooling is constituted. By cooling the motor and maintenance parts of the shutter circumference compulsorily, the heat energy which a shutter holds can be distributed efficiently and the temperature rise of a shutter can be controlled. It can double and the thermal damage of the motor by heat conduction from a shutter can be mitigated.

[0022] In order to distribute more efficiently the heat energy which a shutter holds, as for shutter maintenance parts, it is desirable to use the quality of the material with high thermal conductivity. Moreover, the cooling fin for raising cooling effectiveness etc. may be prepared in the front face of shutter maintenance parts. Moreover, the amount of the air used can be saved by using together the device in which the amount of the air which blows off from an air nozzle is controlled, according to the output of a light source lamp, the temperature of a periphery, etc.

[0023]

[Example 4] Drawing 3 establishes the duct inlet port 7 for compulsive exhaust air near the shutter 3. Since it is an elevated temperature near the condensing section of a shutter (H section) locally, it is the factor which bars the heat dissipation from a shutter wing. By eliminating the gas near [this] the condensing section outside compulsorily, the heat dissipation effectiveness from a shutter wing can be raised, and the temperature rise of a shutter can be controlled. In addition, the duct inlet port for this compulsive exhaust air may be arranged near [which is an elevated temperature similarly] the background section (opposite side of a lamp) of a shutter 3.

[0024]

[Example 5] By combining the above-mentioned examples 1-4 suitably, the temperature rise of a shutter can be suppressed lower and the effectiveness of preventing deformation and breakage of a shutter can be heightened.

[0025]

[The example of a device process] Next, the example of the process using the aligner or the exposure approach which gave [above-mentioned] explanation of a device is explained. Drawing 5 shows the flow of manufacture of minute devices (semiconductor chips, such as IC and LSI, a liquid crystal panel, CCD, the thin film magnetic head, micro machine, etc.). The pattern design of a device is performed at step 1 (circuit design). The mask in which the designed pattern was formed is manufactured at step 2 (mask manufacture). On the other hand, at step 3 (wafer manufacture), a wafer is manufactured using ingredients, such as silicon and glass. Step 4 (wafer process) is called a last process, and forms an actual circuit on a wafer with a lithography technique using the mask and wafer which carried out [above-mentioned] preparation. The following step 5 (assembly) is called a back process, is a process semiconductor-chip-ized using the wafer produced by step 4, and includes processes, such as an assembly process (dicing, bonding) and a packaging process (chip enclosure). At step 6 (inspection), the check test of the semiconductor device produced at step 5 of operation, an endurance test, etc. are

inspected. A semiconductor device is completed through such a process and this is shipped (step 7).
[0026] Drawing 6 shows the detailed flow of the above-mentioned wafer process. The front face of a wafer is oxidized at step 11 (oxidation). An insulator layer is formed in a wafer front face at step 12 (CVD). At step 13 (electrode formation), an electrode is formed by vacuum evaporationo on a wafer. Ion is driven into a wafer at step 14 (ion implantation). A sensitization agent is applied to a wafer at step 15 (resist processing). At step 16 (exposure), printing exposure of the circuit pattern of a mask is carried out at a wafer with the aligner which has the shutter wing temperature rise prevention device which gave [above-mentioned] explanation. The exposed wafer is developed at step 17 (development). At step 18 (etching), parts other than the developed resist image are shaved off. The resist which etching could be managed with step 19 (resist exfoliation), and became unnecessary is removed. By carrying out by repeating these steps, a circuit pattern is formed on a wafer multiplex.
[0027] If the process of this example is used, the device of a high degree of integration for which manufacture was difficult can be conventionally manufactured to low cost.
[0028]
[Effect of the Invention] As mentioned above, according to this invention, the output of a light source lamp is increased, and degradation of a shutter can be controlled even if it raises the illuminance of exposure light. For this reason, the time amount which exposure takes can be reduced by the illuminance rise of exposure light, and the productivity at the time of exposing a semiconductor device can be raised.

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] Arrange the light-emitting part of a light source lamp near the primary focus of an ellipse mirror, and the image of this light-emitting part is formed near the secondary focus of this ellipse mirror through this ellipse mirror by the flux of light from this light-emitting part. The illumination-light study system which forms the image of this light-emitting part near the plane of incidence of the optical integrator which arranged two or more microlenses two-dimensional through the image formation system, and illuminates an irradiated substrate through this optical integrator, In the aligner possessing the projection optics which carries out contraction projection of the pattern of this irradiated substrate on the recorded body, and the shutter wing prepared on this optical path in order to open and close the exposure optical path between said light-emitting part and the recorded body The aligner characterized by having a means to prevent the temperature rise of said shutter wing.
[Claim 2] The aligner according to claim 1 with which said shutter wing is characterized by opening and closing said exposure optical path near [said] the secondary focus.
[Claim 3] when said temperature rise prevention means is formed in the front face of said shutter wing and controls light energy absorption of this shutter wing, the temperature rise of this shutter wing is prevented -- an increase -- reflection -- the film -- it is -- the aligner according to claim 1 or 2 characterized by things.
[Claim 4] The aligner according to claim 1 or 2 characterized by being the protective coat which prevents the temperature rise of this shutter wing when said temperature rise prevention means is formed in the front face of said shutter wing, prevents deterioration of this shutter wing front face and controls the increment with time in a light energy absorbed amount.
[Claim 5] The aligner according to claim 1 or 2 characterized by being an air-cooling means to cool this section near the shutter wing and to prevent the temperature rise of this shutter wing when said temperature rise prevention means blows a gas on said section near the shutter wing compulsorily and applies it to it.
[Claim 6] The aligner according to claim 1 or 2 characterized by said temperature rise prevention means being an air-cooling means to prevent the temperature rise of this shutter wing by eliminating the gas near [said] the shutter wing compulsorily.
[Claim 7] The device manufacture approach characterized by manufacturing a device using an aligner according to claim 1 to 6.

[Translation done.]